DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF AIR QUALITY
Permit Application Analysis
A0000080

May 20, 2016

NAME OF FIRM: Merit Energy Company

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RESPONSIBLE OFFICIAL: Arlene Valliquette
N. Div. Regulatory Manager

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TYPE OF OPERATION: Sour crude oil and natural gas production facility

FACILITY NAME: **Shoshone Unit Battery**

FACILITY LOCATION: NE¼ SE¼ Section 20, T53N, R101W
Latitude: 44.55690° Longitude: -109.03850°
Park County, Wyoming

DATE FACILITY BECAME OPERATIONAL: 8/1/1993, modified 12/1/2014

REVIEWER: Christopher Sorensen, Air Quality Engineer

PURPOSE OF APPLICATION: Merit Energy Company filed this application to modify the Shoshone Unit Battery with the replacement of the existing 1,000-bbl sales oil tank with two (2) 400-bbl sales oil tanks.

Production and equipment for the eighteen wells are co-located and/or shared and all associated air emissions are aggregated for permitting determinations.

PERMIT HISTORY: The Shoshone Unit Battery currently operates under an air quality waiver issued July 29, 1993. This permit shall supersede all previous air quality permits and waivers for the Shoshone Unit Battery.

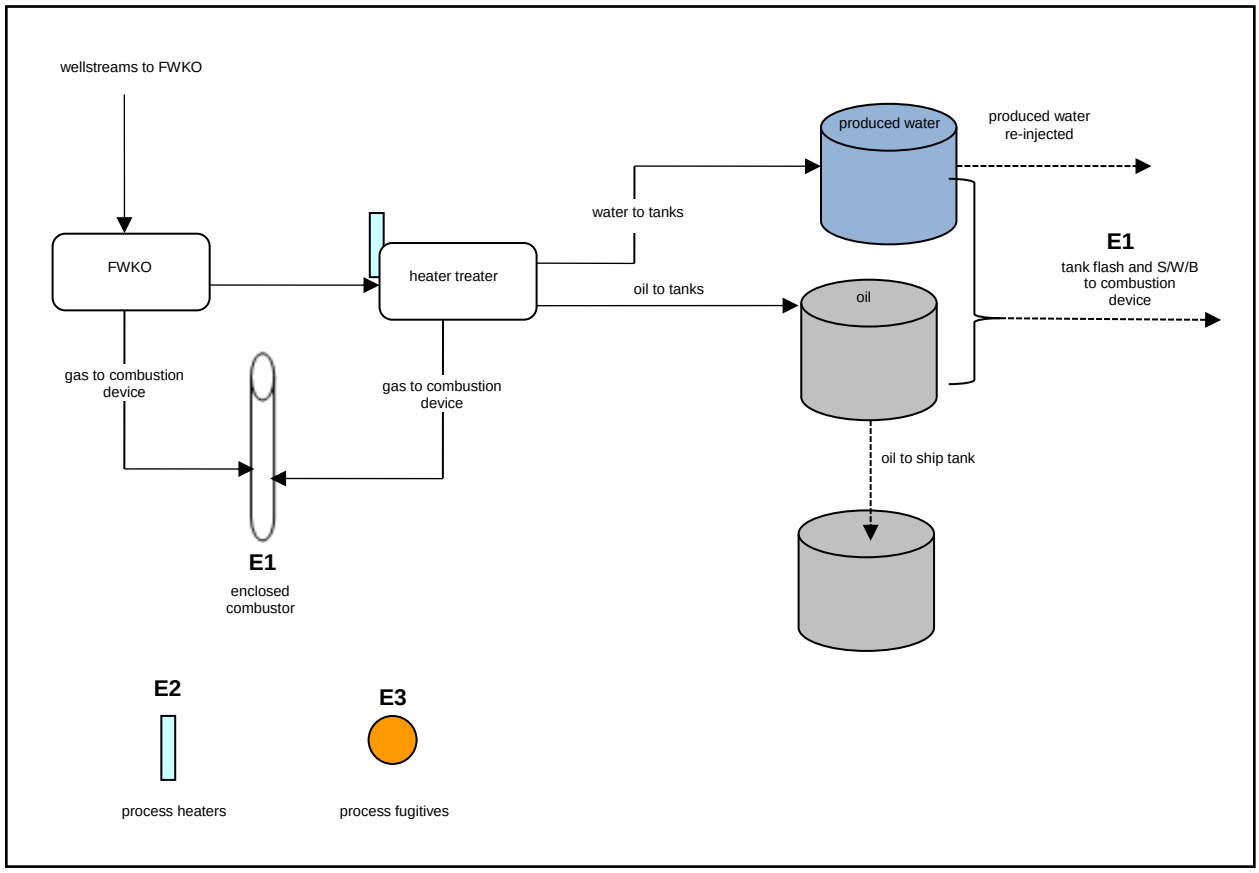
The following equipment operates at the Shoshone Unit Battery:

- one (1) heater treater w/ 1.5 million Btu per hour (MMBtu/hr) heater
- two (2) three-phase free water knockouts, unheated
- one (1) three-phase test treater, unheated
- one (1) two-phase gas vessel, unheated
- one (1) 500-barrel (bbl) slop oil tank
- two (2) 500-bbl reject oil tanks
- one (1) 500-bbl produced oil tank
- two (2) 400-bbl oil ship tanks
- three (3) 400-bbl produced water tanks (one tank out of service)

Equipment list continued:

- two (2) emergency produced water discharge pits
- one (1) common smokeless combustion device w/ continuous pilot monitoring system (tank and produced gas control)

PROCESS DESCRIPTION: The following is a schematic representation of the production process at this facility. A complete process description is found in the permit application.



ESTIMATED EMISSIONS: (summarized in the attached tables)

oil storage tank:

flashing and standing/working/breathing (S/W/B)losses:

Uncontrolled VOC and HAP emissions were estimated using E&P Tanks V2.0 software based on the average extended hydrocarbon composition of oil from the wells and the daily oil production rate reported by the applicant.

Controlled VOC and HAP emissions (**Emission Source E1, Process Flow Diagram**) are based on the reported 98% destruction efficiency of the common combustion device. Nitrogen oxide (NOx) and carbon monoxide (CO) emissions are based on 0.14 lb NOX/MMBtu, 0.035 lb CO/MMBtu and the calculated volume of incinerated vapors.

produced gas:

Uncontrolled VOC and HAP emissions associated with produced gas were calculated using a mass balance equation based on the metered volume of gas produced and an extended hydrocarbon analysis of the gas.

Controlled VOC and HAP emissions (**Emission Source E1, Process Flow Diagram**) associated with the produced gas are based on the reported 98% destruction efficiency of the common combustion device. Nitrogen oxide (NO_X) and carbon monoxide (CO) emissions from combustion of the produced gas are based on 0.14 lb NO_X/MMBtu and 0.035 lb CO/MMBtu and the volume of produced gas.

process heater: (**Emission Source E2, Process Flow Diagram**)

NOx and CO emissions are based on AP-42 EF for fuel boilers and heaters.

fugitive sources: (**Emission Source E3, Process Flow Diagram**)

VOC and HAP emissions are based on EPA and API EF and the number of fugitive sources at the well sites.

BEST AVAILABLE CONTROL TECHNOLOGY (BACT): The following table summarizes Presumptive BACT notice and control installation requirements under the 2013 Chapter 6, Section 2 Oil and Gas Production Facilities Permitting Guidance (C6 S2 Guidance).

Application, Emissions Controls, Monitoring	Date Due	Date Filed/Installed
Application	3/1/2015 (within 90-days of modification)	1/12/2015
Oil Tank Emission Control	1/30/2015 (within 60-days of modification)	12/1/2014
Active Produced Water Tank Control	1/30/2015 (within 60-days of modification)	12/1/2014
Produced Gas Emission Control	1/30/2015 (within 60-days of modification)	12/1/2014
Continuous Monitoring	1/30/2015 (within 60-days of modification)	12/1/2014

The emission control, reporting and monitoring requirements under the 2013 C6 S2 Guidance have been met.

NEW SOURCE PERFORMANCE STANDARDS (NSPS): The oil storage tanks are operated prior to custody transfer and are not subject to Subpart K, K_a or K_b.

40 CFR part 60, subpart OOOO - *Standards of Performance for Crude Oil and Natural Gas Production, Transmission and Distribution* applies to any new, modified or reconstructed emission source installed after August 23, 2011 at oil and gas production and gas processing facilities. The Shoshone Unit Battery is subject to 40 CFR part 60, subpart OOOO as the facility was modified after the effective date.

PREVENTION OF SIGNIFICANT DETERIORATION (PSD): Emissions from this facility are less than the major source levels defined in WAQSR Chapter 6, Section 4.

CHAPTER 6, SECTION 3 (Operating Permit): Emissions from this facility are less than the major source levels defined in WAQSR Chapter 6, Section 3.

NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS (MACT): Emissions from this facility are less than the major source levels of 10 TPY of any individual HAP and 25 TPY of any combination of HAPs; therefore this facility is not subject to Subpart HH requirements for oil and gas production facilities which are major sources of HAP emissions.

LAND USE PLANNING AND GREATER SAGE-GROUSE PROTECTION: Chapter 6, Section 2(c) of the Wyoming Air Quality Standards and Regulations (WAQSR) requires permit applicants to demonstrate that a proposed facility will be located in accordance with proper land use planning as determined by the appropriate state or local agency. The Wyoming Oil and Gas Conservation Commission (WOGCC) is the state agency charged with authorizing oil and gas wells, and the Commission's permit to drill is verification that an oil and gas production well and associated equipment are located in accordance with proper land use planning.

All permit applicants must also comply with the Governor's Executive Order 2015-4 for the protection of Greater Sage-Grouse habitat. For oil and gas production sites, the WOGCC established the *Greater Sage-Grouse Core Area Protection Policy*. The Division relies on the WOGCC's policy to enforce Executive Order 2015-4 during the permitting process for the drilling of production wells, before oil and gas production sites commence operation.

PROPOSED PERMIT CONDITIONS: The Division proposes to issue an Air Quality Permit to Merit Energy Company for the Shoshone Unit Battery with the following conditions:

1. Authorized representatives of the Division of Air Quality be given permission to enter and inspect any property, premise or place on or at which an air pollution source is located or being installed for the purpose of investigating actual or potential sources of air pollution and for determining compliance or non-compliance with any rule, regulation, standard, permit or order.

2. All substantive commitments and descriptions set forth in the application for this permit, unless superseded by a specific condition of this permit, are incorporated herein by this reference and are enforceable as a condition of this permit.

3. A permit to operate in accordance with Chapter 6, Section 2(a)(iii) of the WAQSR is required after a 120-day start-up period in order to operate this facility.

4. All notifications, reports and correspondence required by this permit shall be submitted to the Stationary Source Compliance Program Manager. Submissions may be done electronically through https://airimpact.wyo.gov to satisfy requirements of this permit.

5. All records required under this permit shall be kept for a period of at least five (5) years and shall be made available to the Division upon request.

6. Periodic training on the proper operation of equipment, systems and devices used to contain, control, eliminate or reduce pollution shall be provided to company personnel whose primary job is to regularly ensure that facility production equipment is functional. The training shall provide these personnel with the ability to recognize, correct and report all instances of malfunctioning equipment, systems and devices associated with air pollution control. These equipment, systems and devices include, but are not limited to combustion units, reboiler overheads condensers, hydrocarbons liquids storage tanks, drip tanks, vent lines, connectors, fittings, valves, relief valves, hatches and any other appurtenance employed to, or involved with, eliminating, reducing, containing or collecting vapors and transporting them to a pollution control system or device.

7. Trained personnel shall perform, at a minimum, a quarterly site evaluation of the operation of the air pollution control equipment, systems and devices under Condition 6. The first quarterly site evaluation shall be conducted within the second quarter after issuance of this permit.

8. An annual preventative maintenance program shall be instituted to inspect and replace equipment, systems and devices under Condition 6 as necessary to ensure their proper operation.

9. Results of all inspections, evaluations and periodic monitoring shall be documented and maintained for review by the Division upon request.

10. Vapors from all oil tanks and all active produced water tanks, including flashing and S/W/B losses, shall be routed to the common combustion device to reduce the mass content of total HAP and VOC emissions in the tank vapors by at least ninety-eight percent (98%) by weight.

11. All produced gas from the well, including gas evolved in the FWKO and gas evolved in the heater treater, which is not used as fuel for process burners and is not routed into a gas collection line or system, shall be routed to the smokeless combustion device to reduce the mass content of VOCs and HAPs in the produced gas vented to the device by at least ninety-eight percent (98%) by weight.

12. The presence of the combustion device pilot flame shall be monitored using a thermocouple and continuous recording device or any other equivalent device to detect and record the presence of the flame. Records shall be maintained noting periods during active well site operation when the pilot flame is not present. The records shall contain a description of the reason(s) for absence of the pilot flame and steps taken to return the pilot flame to proper operation.

13. The combustion device shall be designed, constructed, operated and maintained to be smokeless, per Chapter 3, Section 6(b)(i) of the WAQSR, with no visible emissions except for periods not to exceed a total of five (5) minutes during any two (2) consecutive hours as determined by 40 CFR part 60, appendix A, Method 22.

14. Emission control equipment, including the VOC and HAP emission control system or device, all vent lines, connections, fittings, valves, relief valves, hatches or any other appurtenance employed to contain and collect vapors and transport them to the emission control system or device, shall be maintained and operated during any time the well is producing such that the emissions are controlled at all times. Records shall be maintained noting dates and durations of times during such operation when any VOC or HAP emissions control system or device or the associated containment and collection equipment is not functioning to control emissions as

required by this permit.

15. Effective upon permit issuance, this permit shall supersede the Air Quality Waiver issued on July 29, 1993 for the Shoshone Unit Battery.

16. Merit Energy Company shall comply with all applicable requirements of 40 CFR part 60, subpart OOOO.

Conditions applicable to blowdown/venting operations at the Shoshone Unit Battery:

17. All blowdown/venting notifications, reports, and correspondence required by this permit shall be submitted to the O&G permitting engineer in the Casper Field Office and a copy shall be submitted to the Stationary Source Compliance Program Manager. Submissions may be done electronically through https://airimpact.wyo.gov to satisfy requirements of this permit.

18. Emissions of volatile organic compounds (VOC), hazardous air pollutants (HAP) and hydrogen sulfide (H_2S) resulting from episodes of manual and automatic blowdown and venting of hydrocarbon fluids (liquids and gas) associated with liquids unloading, well purging, wellbore depressurization, hydrate clearing, emergency operations, equipment depressurization, etc., shall be minimized to the extent practicable.

19. During manual blowdown and venting episodes, personnel shall remain on site for the duration of the episode to ensure minimal gas venting occurs by ending the episode as soon as possible once the intended purpose for the episode has been accomplished. The requirement for the personnel to remain on site does not apply to automated blowdown and venting episodes and does not apply to any episode where remaining on site might be considered a safety hazard.

20. For all manual and automatic blowdown and venting episodes the following shall be recorded.

    A. Facility name and legal location (Section, Township, Range, County) and associated Air Quality Permit number;
    B. Date, duration, start and end time;
    C. Reason for episode, i.e. unload well by venting well tubing to blowdown tank, relieve annulus pressure, depressurize well for downhole repair, etc.;
    D. Measure(s) taken to ensure emissions were minimized to the extent practical;
    E. Name of person(s) remaining on site for the duration of manual blowdown and venting episode;
    F. Summary of total volumes of hydrocarbon fluids (barrels of oil, condensate, and water and MCF of gas) recovered and vented;
    G. Estimated pounds of VOC, HAP and H_2S emissions associated with the vapors vented to the atmosphere.

21. VOC, HAP and H_2S emission estimates required under Condition 20(G) shall be determined using the spreadsheets illustrated in Appendix A. The spreadsheets are available for download from the DEQ/AQD website or may be obtained upon request. An emission estimation method other than that provided by the Division may be used upon approval.

22. Within nine (9) months after the date of issuance of this permit, a summary of the information recorded under Condition 20 shall be submitted to the Division. The data required under Condition 20 shall be collected for six (6) months after the date of permit issuance and shall include all gas analyses used as sources for the input information in the spreadsheets required under Condition 21.

23. The Division will reopen and revise this permit, as necessary, to add or delete requirements should the Division determine that:

    A. The practical application of the terms and conditions of the permit are unfeasible or fail to achieve the intent of the permit, or;

    B. The monitoring, recordkeeping, notification or reporting requirements are inadequate to assure compliance with applicable requirements.

Wells Producing to Shoshone Unit Battery

Facility	¼ ¼	Section	Township (N)	Range (W)	Latitude	Longitude
SHOSHONE ST 0-22138 1	SW SE	16	53N	101W	44.56722	-109.02909
SHOSHONE ST 0-22138 5	SW SW	16	53N	101W	44.56556	-109.03449
SHOSHONE C-043963-A 6	SW C	16	53N	101W	44.56334	-109.03173
SHOSHONE ST 0-22138 6	SE SE	17	53N	101W	44.56611	-109.04161
SHOSHONE FED 1	NE SE	20	53N	101W	44.55602	-109.03798
SHOSHONE UNIT 3	NE NE	20	53N	101W	44.56309	-109.03841
SHOSHONE 4	NW SW	21	53N	101W	44.56106	-109.03673
CRICKET FEE 3	SW NE	21	53N	101W	44.55429	-109.03056
CRICKET 4	SW SW	21	53N	101W	44.55306	-109.03619
CRICKET FEE 5	SW NW	21	53N	101W	44.55569	-109.03667
CRICKET FEE 6	SW SW	21	53N	101W	44.55299	-109.03333
CRICKET 15	SW SE	21	53N	101W	44.55236	-109.03261
CRICKET 16	SW NW	21	53N	101W	44.55761	-109.0325
CRICKET 17	SW NW	21	53N	101W	44.55661	-109.03421
CRICKET FEE 9	SW SW	21	53N	101W	44.55089	-109.03239
CRICKET PATENTED 1	SW NW	21	53N	101W	44.55487	-109.03321
CRICKET FEE 8	SW SW	21	53N	101W	44.55299	-109.03541
CRICKET FEE 7	NW NE	28	53N	101W	44.54806	-109.03089

EQUIPMENT LIST

- one (1) heater treater w/ 1.5 million Btu per hour (MMBtu/hr) heater
- two (2) three-phase free water knockouts, unheated
- one (1) three-phase test treater, unheated
- one (1) two-phase gas vessel, unheated
- one (1) 500-barrel (bbl) slop oil tank
- two (2) 500-bbl reject oil tanks
- one (1) 500-bbl produced oil tank
- two (2) 400-bbl oil ship tanks
- three (3) 400-bbl produced water tanks (one tank out of service)
- two (2) emergency produced water discharge pits
- one (1) common smokeless combustion device w/ continuous pilot monitoring system (tank and produced gas control)

EMISSIONS SUMMARY

Shoshone Unit Battery 197 BOPD maximum rate and 9.5 MCFD [1]						
SOURCE	EMISSIONS (TPY) [2]					
	VOC	HAP	NO_X	CO	H_2S	SO_2
Oil Tanks (flashing and S/W/B)						
UNCONTROLLED	11.0	0.1	--	--	insig	--
CONTROLLED	0.2	insig	insig	insig	--	insig
Produced Gas						
UNCONTROLLED	23.4	0.9	--	--	1.9	--
CONTROLLED	0.5	insig	0.3	0.1	--	3.6
Fugitives	12.6	1.3	--	--	0.2	--
Process Heater	insig	insig	0.7	0.6	insig	insig
Total Uncontrolled Facility Emissions	**47.0**	**2.3**	**0.7**	**0.6**	**1.9**	**--**
Total Controlled Facility Emissions	**13.3**	**1.3**	**1.0**	**0.7**	**0.2**	**3.6**

[1] daily rates projected by the applicant

[2] rounded to the nearest 0.1 ton

Appendix A

Blowdown/Venting Spreadsheet

Spreadsheet for calculating emissions associated with gas vented from ANNULUS when there is an associated pressure drawdown ($P_1 > P_2$).

	INPUT		CALCULATED		
Gas HAP Content (**wt%**)	6				
Gas VOC Content (**wt%**)	15				
Gas Compressibility (**Z**)*	0.98				
Gas Molecular Weight	17.74	lb/lbmol			
Universal Gas Constant (**R**)	10.732	ft^3 psi/°R lb-mol			
Starting Pressure (P_1)	1500	psig	1512	psia	
Ending Pressure (P_2)	0	psig	12	psia	
Starting Temperature (T_1)	55	°F	515	°R	
Ending Temperature (T_2)	55	°F	515	°R	
Tubing Outside Diameter (**OD**)	2.875	in	Starting Gas Density (ρ_1)	4.9521	lb/ft³	$\rho_1=(P_1*MW)/R*T_1*Z$
Casing Inside Diameter **(ID)**	3.92	in	Ending Gas Density (ρ_2)	0.0393	lb/ft³	$\rho_2=(P_2*MW)/R*T_2*Z$
Annulus Length (**AL**)	500	ft		4.9128	lb/ft³	$\rho_1 - \rho_2$
				0.0387	ft^3/ft	Annular Volume per Linear Foot **(AV)**

Gas Release	**95**	**lb**	Pounds of Gas per Linear Foot = (ρ_1 - ρ_2) * (**AL**) * (**AV**)
Gas Release	**2,032**	**SCF**	Conversion to SCF = (Gas Release (lb)) * (379 SCF/lb-mol) / (molecular wt of gas (lb/lb-mol))
VOC Release	**14**	**lb**	VOC release = (Gas Release (lb)) * (Gas VOC Content / 100)
HAP Release	**6**	**lb**	HAP release = (Gas Release (lb)) * (Gas HAP Content / 100)

Tubing Sizes			Casing Sizes		
nom.	OD inches	ID inches	nom.	OD inches	ID inches
2 3/8	2.375	1.94	4 1/2	4.5	3.92
2 7/8	2.875	2.26	4 3/4	4.75	4.2
3 1/2	3.5	2.76	5	5	4.41
			5 1/2	5.5	4.82

* For the purposes of this spreadsheet, assume the starting Z factor = the ending Z factor.

Spreadsheet for calculating emissions associated with gas vented from tubing or casing when <u>there is an associated pressure drawdown ($P_1 > P_2$)</u>

	INPUT		CALCULATED		
Gas VOC Content (wt%)	50				
Gas HAP Content (wt%)	6				
Gas Compressibility (**Z**)*	0.95				
Gas Molecular Weight	17.74	lb/lbmol			
Universal Gas Constant (**R**)	10.732	ft^3 psi/°R lb-mol			
Starting Pressure (P_1)	600	psig	612	psia	
Starting Temperature (T_1)	600	°F	1060	°R	
Ending Pressure (P_2)	200	psig	212	psia	
Ending Temperature (T_2)	55	°F	515	°R	
Tubing or Casing Inside Diameter (**ID**)	1.875	in	Starting Gas Density (ρ_1)	1.0046	lb/ft³	$\rho_1=(P_1*MW)/R*T_1*Z$
Tubing/Casing Length (**TL**)	15000	ft	Ending Gas Density (ρ_2)	0.7163	lb/ft³	$\rho_2=(P_2*MW)/R*T_2*Z$
				0.2883	lb/ft³	$\rho_1 - \rho_2$
				0.0192	ft^3/ft	Volume per Linear Foot **(TV)**

Gas Release	**83**	**lb**	Release = (ρ_1 - ρ_2) * (**TL**) * (**TV**)
Gas Release	**1772**	**SCF**	Conversion to SCF = (Gas Release (lb)) * (379 SCF/lb-mol) / (molecular wt of gas (lb/lb-mol))
VOC Release	**41**	**lb**	VOC release = (Gas Release (lb)) * (Gas VOC Content / 100)
HAP Release	**5**	**lb**	HAP release = (Gas Release (lb)) * (Gas HAP Content / 100)

Tubing Sizes			Casing Sizes		
nom.	OD inches	ID inches	nom.	OD inches	ID inches
2 3/8	2.375	1.94	4 1/2	4.5	3.92
2 7/8	2.875	2.26	4 3/4	4.75	4.2
3 1/2	3.5	2.76	5	5	4.41
			5 1/2	5.5	4.82

* For purposes of these calculations assume starting Z = ending Z.

Spreadsheet for calculating blowdown/venting emissions from tubing, casing or annulus when there is minimal or no pressure differential during the event ($P_1 = P_2$)

	INPUT		CALCULATED	
Fill in the five parameters below.	↓			
Average Daily Gas Production Rate	1	MSCFD		
Vented Gas VOC Content	50	wt%		
Vented Gas HAP Content	35	wt%		
Vented Gas Molecular Weight	20	lb/lb-mol		
Blowdown Duration	120	minutes		
			Total Gas Emitted	0.083 MSCF
			VOC Emissions	2.2 lbs
			HAP Emissions	1.5 lbs